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(54) FIRE RESISTANT PANELS AND WALL SYSTEM

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Abstract of the Disclosure

This invention is directed to a battenless fire resistant demountable partition system. The design comprises gypsum wallboard laminate panels interconnected with non-load bearing steel framing members. The fire resistant wallboard used in the panels is that known in the industry as type X. One suitable type is that sold under the trade mark FIRESTOP-3. The partition system has been assigned a fire resistance rating of one hour when tested in accordance with the Standard for Fire Tests of Building Construction and Materials, Underwriters' Laboratories of Canada Test Procedure S101.

This invention is directed to a battenless fire resistant partition design. More particularly, this invention is directed to a battenless demountable wall and partition assembly which achieves a one hour fire resistant rating when tested according to standard laboratory fire testing techniques.

BACKGROUND OF THE INVENTION

In recent years, in the construction industry, there has been an increasing emphasis on the use of specific fire rated designs especially in mercantile or institutional buildings. These design specifications are set and listed by various independent testing laboratories. The independent testing laboratories also keep a list of suppliers whose products have passed their specifications. A major testing laboratory of this type in Canada is Underwriters' Laboratories of Canada, Toronto, Canada. Underwriters' Laboratories of Canada is a non-profit organization which is recognized across Canada by various Federal, Provincial and Municipal authorities, architects and insurance inspection agencies. In harmony with the increasing use of demountable wall and partition assemblies in commercial building construction it is desirable that such assemblies be designed to resist a fire hazard.

Under current construction procedures, it is advantageous in order to market a particular construction material or design to have the material or design tested by Underwriters' Laboratories of Canada and receive from that organization an approved fire resistance listing. Various public authorities and architects, when designing a new building, will specify a certain construction design

involving a fire resistance rating for a certain function in the building, and frequently the specification is in terms of an approved listing with Underwriters' Laboratories of Canada.

For many years, in constructing demountable wall and partition systems for office buildings, and other erected building structures, the standard technique has been to use battens (steel, aluminum vinyl, etc.) to cover the screw heads at the joint seams of the wall panels. Such battens increase the cost of the partition and are time consuming to install.

To provide a more economic demountable wall system, efforts have been made in recent years to designing a functional wall partition system which is battenless. Several battenless wall panel systems are now on the market. One such system is sold under the trade mark MODULAIRE by Westroc Industires Limited and is the subject of U.S. Patent 3,906,695.

It would be advantageous to have a system which was not only battenless but also had an approved fire resistance rating of one hour. It would also be advantageous to have a system which does not use glue and is fastened together entirely by screws to provide stronger construction.

It would also be advantageous to have a system which has panels having an edge construction that permits supporting studs to be slipped easily into recesses built into the panel edges and that protects the recesses so that they are not readily susceptible to damage during shipping or installation.

Finally, it would be advantageous to have a system which has panels having an edge construction that

has a built-in tolerance that enables the panels without construction difficulty to accommodate minor variations in panel dimension and erection site dimension due to uneven floors and ceilings and off-vertical walls.

SUMMARY OF THE INVENTION

We have designed a battenless demountable wall and partition system which achieves a one hour fire resistance rating according to tests conducted by the Underwriters' Laboratories of Canada.

The new wall and partition system that we have designed has the following characteristics:

1. The system is battenless, demountable and has a neat uncluttered finished appearance;
2. The system is identical in finished appearance and trim detail with a standard non-fire rated battenless wall partition system sold on the market-place under the trade mark MODULAIRE by Westroc Industries Limited. As with the MODULAIRE system, the new fire rated wall system is based on 30 inch wide gypsum wallboard panels;
3. The new wall and partition assembly provides a one hour resistance to the passage of flame and dangerous transmission of heat when tested in accordance with the performance requirements contained in the Standard for Fire Tests of Building Construction and Materials, ULC-S101.
4. The new design assembly is listed by Underwriters' Laboratories of Canada in Volume II Building Construction Handbook, as wall and partition assembly W403.

The new fire rated design consists of a plurality of opposing laminated panel membranes mechanically fixed to steel floor and ceiling tracks and separated by aluminum or steel "I" studs. Grooves are located in the edges of adjacent laminated panel membranes and accommodate the flanges of the "I" studs.

The laminated panels are composed of a seven-sixteenth inch thick fire resistant gypsum wallboard bonded to a half inch thick fire resistant wallboard known in the industry as a type X board. One type of half inch thick wallboard which is suitable is sold by Westroc Industries Limited under the trade mark FIRESTOP-3. The formulation of the half inch thick wallboard sold under the trade mark FIRESTOP-3 is of a proprietary nature, the details of which are in the files of Underwriters' Laboratories of Canada for use in the Follow-Up Service Programme. Other suitable half inch thick wallboard is that sold under the trade mark FIREGUARD by Domtar Construction Materials, that sold under the trade mark FIRECODE by Canadian Gypsum Company and that sold under manufacturer's internal number TRFP-3 by Truroc. The seven-sixteenth inch thick wallboard used in the laminated panel should contain a minimum of three pounds per thousand square feet glass fiber dispersed homogeneously throughout the core of the wallboard. The glass fibers range in length from one eighth inch to one inch and fiber diameters range from 0.00002 to 0.00005 inches.

The laminating process comprises the bonding together of the half inch thick type X wallboard and the seven-sixteenth inch fire resistant wallboard with an adhesive having a synthetic resin emulsion base of the polyvinyl acetate type such as adhesive 4772 supplied by the Swift Canadian Company Limited, Bramalea, Ontario, or adhesive TS-439 supplied by Stein Hall Limited, West Hill, Ontario. Adhesive TS-439 is indicated by the manufacturer as having the following

characteristics:

Solids:	59.5 ± 1.5 % by weight
Viscosity:	6000 ± 300 cps (BROOKFIELD RUF, #4/20 rpm/24 deg. C)
Relative Density:	1,068 ± .01
pH	4.5 ± 0.5

The back of the half inch thick board is bonded to the face of the seven-sixteenth inch board. The adhesive is applied to one board by means of a six inch wide hand held roller in strips located four inches in from each edge and at the centre at the rate of nine pounds per thousand square feet of board surface. After the boards are in contact and properly aligned a few power driven staples may be used to restrict movement. Due to the adhesive bonding properties the wallboard must be laminated at a temperature above 40°F.

The invention also consists of a fire resistant wall system incorporating a plurality of the panels as described above and I-shaped vertically disposed metal wall studs one and one-half inches wide by two and one-half inches deep with a flange thickness of 0.048 inches and a web thickness of 0.065 inches, wherein the seven-sixteenth inch thick gypsum wallboard is shaped along the vertical edges of the face adjacent to the back of the half inch thick wallboard such that the shaped area forms a groove in the vertical edges of the wall panels and wherein each adjacent pair of the plurality of wall panels is secured in vertical edge-to-edge relationship by mating engagement of the grooves of adjacent vertical edges with monoplanar flanges of one of the I-shaped wall studs, the flanges being of width and thickness to be received snuggly in the grooves.

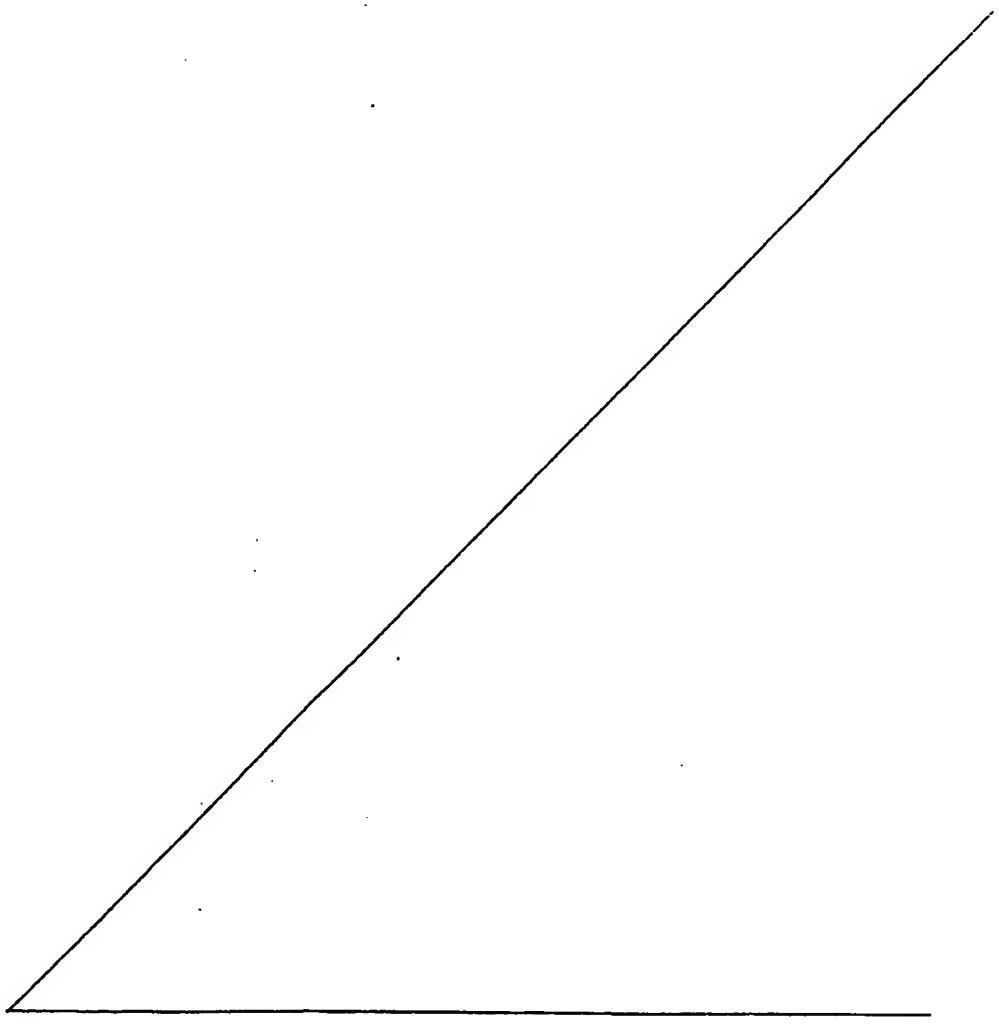
In the fire resistant wall system, the half inch thick type X wallboard should be slightly greater in width than the seven-sixteenth inch thick gypsum wallboard. The edges of the half inch thick type X wallboard should have a slight angle of about 3° in the direction of the seven-sixteenth inch thick gypsum wallboard so that when two panels are juxtaposed with one another, with the half inch thick type X facing outwardly, the exterior edges contact each other to provide a trim neat close fitting joint. In this way when adjacent pairs of the panels are engaged about the flanges of the I-shaped wall studs, the edges of the outer faces of the wall panels are snuggly juxtaposed, and the vertically adjacent edges of the seven-sixteenth inch gypsum wallboard are spaced sufficiently to accommodate the web of the vertical I-shaped wall stud therebetween.

In the fire resistant wall system, there must be a first and second plurality of the wall panels, wherein the second plurality of wall panels is disposed parallel to the first plurality of wall panels and pairs of wall panels of the second plurality are disposed about the other set of monoplanar flanges of said I-shaped wall studs. In lieu of the I-shaped wall studs there can be J-shaped wall studs, with the single flange at the base of the "J" parallel to the monoplanar flanges.

The invention is directed to a laminated wall panel comprising (a) type X fire resistant gypsum wallboard laminated to (b) glass fiber impregnated gypsum wallboard. The glass fiber content of wallboard component (b) can be approximately three pounds per one thousand square feet. The wallboard component (a) can be about one-half inch thick and wallboard component (b) can be about seven-sixteenth inch thick.

The type X wallboard can be that sold under the trade mark FIRESTOP-3.

The wallboard component (a) and the wallboard component (b) can be bonded together with an adhesive which has a synthetic resin emulsion base of the polyvinyl acetate type. The adhesive can be selected from the group consisting of adhesive 4772 and adhesive TS-439. A groove can be located between the edges of the wallboard component (a) and wallboard component (b) and the groove can run substantially the length of the panel. Wallboard component (a) can be greater in lateral width than wallboard component (b). The edges of wallboard



components (a) and (b) and the groove between the edges of the two wallboard components should be covered with wallboard liner. The edge of wallboard component (a) is angled about 3 degrees from the perpendicular in the direction of wallboard component (b).

A one hour fire rated wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of vertically disposed studs of I-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of the plurality of wall panels is secured in abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of said I cross section shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels.

A one hour fire rated wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of the plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the I-shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels, and wherein a second plurality of panels are arranged in a row in side by side abutting relationship the row being parallel

with the first row of panels, and the second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the I-shaped studs opposite to the flanges of the I-shaped studs engaging the edges of the plurality of panels forming the first row of panels.

A one hour fire rated wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of spaced vertically disposed studs of J-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of said plurality of wall panels is secured in said abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of the heads of said J cross section shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels.

A one hour fire rated wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of a first plurality of spaced vertically disposed studs of J-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of the plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the heads of the J-shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels, and wherein a second plurality of panels are arranged in a row in side by side

abutting relationship the row being parallel with the first row of panels, and the second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the head flanges of a second plurality of spaced vertically disposed studs of J-shaped cross section corresponding in number with the first plurality of J-shaped studs, said second plurality of J-shaped studs being arranged in abutting relationship with the first plurality of J-shaped studs but being disposed in opposite direction, the flanges of the second plurality of J-shaped studs being of a thickness to be received snuggly in the grooves of the second plurality of abutting panels.

A wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of the plurality of wall panels is secured in the abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of said I cross section shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels, the wall system meeting the performance requirements contained in the standard for Fire Tests of Building Construction and Materials, ULC-S101.

A wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of spaced vertically disposed

studs of I-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of the plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the I-shaped cross section shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels, and a second plurality of panels corresponding in number with the first plurality of I-shaped studs are arranged in a row in side by side abutting relationship the row being parallel with the first row of panels, and the second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the I-shaped studs opposite to the flanges of the I-shaped studs engaging the edges of the plurality of panels forming the first row of panels, the wall system meeting the performance requirements contained in the standard for Fire Tests of Building Construction and Materials, ULC-S101.

A one hour fire rated wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of the plurality of wall panels is secured in the abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of the heads of the J cross section shaped studs, the flanges

being of a thickness to be received snuggly in the grooves of abutting panels, the wall system meeting the performance requirements contained in the Standard for Fire Tests of Building Construction and Materials, ULC-S101.

A wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of a first plurality of spaced vertically disposed studs of J-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of the plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the heads of the J-shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels, and wherein a second plurality of panels corresponding in number with the first plurality of panels are arranged in a row in side by side abutting relationship the row being parallel with the first row of panels, and the second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the head flanges of a second plurality of spaced vertically disposed studs of J-shaped cross section corresponding in number with the first plurality of J-shaped studs the second plurality of J-shaped studs being arranged in abutting relationship with the first plurality of J-shaped studs but being disposed in opposite direction, the flanges of the second plurality of J-shaped studs being of a thickness to be received snuggly in the grooves of the second plurality of abutting panels, the wall system meeting the performance

being of a thickness to be received snuggly in the grooves of abutting panels, the wall system meeting the performance requirements contained in the Standard for Fire Tests of Building Construction and Materials, ULC-S101.

A wall system can be constructed incorporating a plurality of the panels described previously in combination with a corresponding number of a first plurality of spaced vertically disposed studs of J-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of the plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the heads of the J-shaped studs, the flanges being of a thickness to be received snuggly in the grooves of abutting panels, and wherein a second plurality of panels corresponding in number with the first plurality of panels are arranged in a row in side by side abutting relationship the row being parallel with the first row of panels, and the second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the head flanges of a second plurality of spaced vertically disposed studs of J-shaped cross section corresponding in number with the first plurality of J-shaped studs the second plurality of J-shaped studs being arranged in abutting relationship with the first plurality of J-shaped studs but being disposed in opposite direction, the flanges of the second plurality of J-shaped studs being of a thickness to be received snuggly in the grooves of the second plurality of abutting panels, the wall system meeting the performance

laminates composed of FIRESTOP-3 gypsum wallboard 1, are adhesively bonded to respective pairs of fire resistant gypsum wallboard 2.

The edges of the wallboard laminate panels fit onto vertical"I" studs. As can be seen in Figure 1, the flange portion of the "I" studs fits into grooves formed between the two components 1 and 2 of the wallboard laminate. To take into account the web thickness of the "I" stud, the inner gypsum wallboard component 2 should be of slightly less width than the outer wallboard component 1. When two adjoining wallboard laminates are mounted onto the flange of the "I" stud, they are held securely in place and no batten is required. Moreover, the edges of the adjoining panels 1 are carefully molded so that the adjoining panels 1 fit snuggly against one another and provide a neat joint.

A feature of the invention is that, contrary to standard construction practice, the vertical "I" stud 3 is suspended between the ceiling track 4 and the floor track 5. No mechanical fastenings are used to connect the vertical "I" stud 3 with either the ceiling or floor track.

Figure 2 provides a more detailed illustration of the manner in which the top of the vertical "I" stud 3 is installed in relation to the ceiling track 4. The top end of the stud 3 can have a pair of notches which are dimensioned to accommodate the flanges of the ceiling track 4. One of these notches 6 is shown in Figure 2. These notches accommodate the vertical expansion of the "I" stud 3 in a fire situation. A strip of ceiling trim

provide a finished appearance at the top of the wall panel where it meets the ceiling.

Figure 3 provides a detailed illustration of the manner in which the laminated wallboard panel consisting of wallboard components 1 and 2 connects with and fits about the flanges of the "I" stud 3. As can be seen, the inner facing of the seven-sixteenth inch thick gypsum wallboard 2 is formed so that when it is laminated to the half inch thick wallboard 1, there is a groove 8 which runs along the entire edge of the laminated wallboard panel and permits the edge of the laminated wallboard panel to fit over the flange of the "I" stud 3. The groove 8 enables the laminated wallboard panel to fit securely and snuggly onto the "I" stud 3.

Figure 4 shows in detail the manner in which the base of the vertical "I" stud 3 is installed in relation to the floor track 5. As with the top of the "I" stud 3, a pair of notches 9 are formed in the base of the "I" stud 3. This pair of notches 9 fits over the pair of flanges of the floor track 5. To provide a finished appearance at the point where the base of the wall panel 1 meets with the floor, a base trim 10 is used at the base of the panel. The base trim 10 hides any screws in the wallboard base and is screwed in place. Then, to hide the screws in the base trim 10, "snap-on" cap 20 fits over ridges formed in the base trim 10.

Figure 5 shows in detail a top view of the manner in which two sets of wallboard panels meet together at a corner. At the corner, two vertically extending steel "C" studs 11a and 11b are used. One of these "C" studs 11a

is placed between and at the end of a pair of wallboard panels which are cut to terminate at a one point. These panels are screwed to the "C" stud 11a. A similar second "C" stud 11b is fitted between the second pair of laminated wallboard panels. However, the outer wallboard panel instead of terminating at the point where it meets the end of the second "C" stud 11b, carries on for a distance sufficient to cover the end width of the pair of commonly ending wallboard laminates and the lateral dimension of the first "C" stud 11a. The outer overlapping section of the wall panel 1 and 2 is screwed to the first "C" stud 11a rather than to the second "C" stud 11b, to which its mating laminate section is fastened. This design provides a relatively simple, neat and strong corner system. To lend a finished appearance to the corner section, an L-shaped trim 13 is screwed by trim screws 12 to the outer corner of the adjoining laminated wallboard sections and then to hide the screws "snap-on" caps 14 are placed over the ridges formed in the L-shaped corner trim 13.

Figure 6 shows an end view of the manner in which the pair of laminated wallboard panels meet with the floor. The floor track 5 is fastened to the floor by a floor screw 15. The pair of opposing laminated wallboard panels fit along each side of the flanges of the floor track 5. The opposing laminate panels can be screwed to the flanges of the floor track 5 by a set of panel screws 16. Base trim 10 formed of a suitable plastic such as polymerized vinyl chloride is fastened to the base of the opposing laminated wallboard panels by a set of trim screws 17. The base trim 10 covers the exposed heads of the panel screws 16 that are used to fasten the

opposing laminated wallboard panel sections to the flanges of the floor track 5. Then, to hide the heads of the trim screws 17 used to fasten the trim 10 to the opposing laminated wallboard sections, "snap-on" caps 20 are placed over the ridges formed in the floor trim 10.

Figure 7 shows in end view the manner in which the opposing laminated wallboard panels are fastened to the ceiling track 4. The ceiling track 4 is screwed to the ceiling by a set of ceiling screws 18. Ceiling trim 7 is then placed on the outward faces of the opposing laminated panels at the location where the panels meet the ceiling. The opposing wallboard panels and the trim 7 are then screwed by screws 16 to the flanges of the ceiling track 4. Finally, to hide the heads of the screws 16, snap-on caps 19 are snapped over the ridges formed in the ceiling trim 7.

Figure 8 shows a detailed top view of the manner in which the side faces of the laminated wall panels fit over the flanges of the vertically extending "I" stud 3. Grooves 8 are present in the side edges of each of the adjacent and opposing laminated wallboard panels 1 and 2 and these are dimensioned to fit over the flanges of the "I" stud 3. Further, it will be seen that when the adjacent laminated wall panels 1 and 2 are fitted over the flanges of the studs 3, there is a slight "V"-shaped opening extending inwardly in the direction of the "I" stud 3. It has been found advantageous to have this slight inwardly extending "V"-shaped opening (the edge of each wallboard 1 is angled inwardly about 3° from the perpendicular) so that a neat snug fit can be obtained between the adjacently positioned wall laminated wallboard panels 1 and 2.

With this construction of panel comprising wallboard components 1 and 2, the edges of the panel are enclosed entirely with wallboard liner (cardboard material used to enclose the gypsum interior of the wallboard). This is important and is a considerable improvement over prior constructions in the field. The liner at the panel edges completely encloses the gypsum to prevent it from falling out and preserves the dimensions of the groove 8. In prior constructions, the gypsum is exposed at the wallboard edges which permits the gypsum to fall out and makes the edges susceptible to damage. Panels with damaged or imperfect edges must be discarded which is wasteful and expensive.

Figure 9 shows an alternative method of forming a corner for the fire rated laminated wallboard assembly. A box stud 21 is used in place of one of the "C" studs 11a and 11b as was shown in Figure 5. Otherwise, the respective components are the same, and the illustration in Figure 9 details the components and how the alternative corner is constructed. The "L" trim 13 is screwed by trim screws 12 into the boxed stud 21. Caps 14 are then snapped over the ridges in the "L" trim 13 to hide the heads of the screws 12.

Figure 10 shows an alternative method of joining together adjacent laminated wallboard panels. Instead of the usual vertical "I" studs 3 (as shown in Figure 8), we use two "J" studs 22. The two "J" studs 22 are opposed to one another and fit alongside one another and each has a flange section which fits between the groove 8 of the respective laminated wallboard sections 1 and 2. The advantage of this "J" stud 22 construction is that

one side of the wall or partition can be constructed independently of the other, thus increasing the flexibility of the assembly.

Figure 11 shows a top view of the manner in which an opposing pair of laminated wallboard panels are connected to a wall. A "C" stud 11 is screwed to the wall by wall screw 23. Then, the ends of the two opposing wallboard panels are screwed to the flanges of the "C" stud 11 by further screws 16. Then, trim 24 similar to the ceiling trim 7 described previously in connection with Figure 7 is screwed to the ends of the opposing panels. Finally, caps 25 are snapped over the ridges in the trim 24 to hide the heads of the screws 16.

Figure 12 shows an alternative method of fastening the pairs of laminated wallboard panels to the ceiling. This alternative system is useful in "dropped-ceiling" constructions. The ceiling track 4 is secured to the main ceiling of the building by ceiling screws 18. Then, the opposing faces of laminated wallboard panel 1 and 2 are screwed by screws 16 to the flanges of the ceiling track 4. Subsequently, at the location of the "dropped-ceiling 26, ceiling trim 27 is screwed to the pair of opposing laminated wallboard sections by further trim screws 17. Finally, to obscure the heads of the screws 17, caps 19 are snapped over the ridges formed in the ceiling trim 27.

EXAMPLE

The experimental work was carried out at Underwriters' Laboratories of Canada with the objective of establishing a Fire Resistance Rating for the test assembly described

herein by subjecting the assembly to fire endurance and hose stream tests in accordance with the Standard for Fire Tests of Building Construction and Materials, ULC-S101.

The detailed dimensions of the test assembly are important in meeting the fire testing standards of Underwriters' Laboratories and accordingly are set out herein in detail. The gypsum wallboard laminate was composed of a 30 inch wide, 1/2 inch thick, 10 foot long sheet of vinyl covered fire resistant gypsum wallboard which is marketed by Westroc Industries Limited under the trade mark FIRESTOP-3, and a 29-5/8 inch wide, 7/16 inch in effective thickness, 10 foot long sheet of fire resistant gypsum wallboard which is impregnated with glass fiber to a level of at least three pounds per thousand square feet of wallboard.

The top and bottom channel tracks were 1-3/8 inches deep by 1-5/8 inches wide, by 10 feet long formed of cold rolled steel.

The aluminum "I" studs were 2-1/2 inches wide by 1-1/2 inches deep across the flange with a flange thickness of 0.048 inches and a web thickness of 0.065 inches. The studs were 9 feet 10-1/3 inches long with two V-notches 2 inches deep and approximately 5/8 inches wide at the base cut into the web adjacent the flanges at each end of the studs.

The assembly was erected so as to fill the 10 foot by 10 foot masonry opening of the test frame under supervision of the Underwriters' Laboratories of Canada.

The channel tracks were fastened to the lintel of the opening with No. 6 drywall screws 1-5/8 inches

long on 24 inch centres and to the sill by means of concrete nails on the same centres. Steel C studs were attached to the sides of the opening using No. 6 drywall screws 1-5/8 inches long on twenty-four inch centres.

Two of the laminated panels were cut to a face width of 15 inches and placed into position with the cut edge against the north side of the opening. These panels were held in place by means of No. 6 drywall screws on 3 inch centres, starting 3 inches from each edge of the board, at the top and bottom edges of the board. The screws were power driven three quarters of the way into the assembly and then tightened to the proper depth using a hand tool.

An aluminum stud was cut to a length of 9 feet 10-1/2 inches and two V-notches, approximately 2 inches deep and 5/8 inch wide at the base, were cut into each end of the stud with 1-1/8 inch clear web between them. Then the stud was positioned by sliding the flanges between the two layers of the laminated panels and leaving approximately equal gaps between the ends of the stud and the sill and lintel of the opening.

Next a full width panel was positioned by sliding it along the face of the channel tracks until the edge of the face panel was butted to the edge of the panel already in position. Again, a flange of the aluminum stud occupied the space between the layers of the laminated panel. The panel was then screw attached to the top and bottom tracks by means of No. 6 Type S drywall screws, 1-5/8 inches long on 8 inch centres.

The erection of the balance of the assembly was carried out in the same way with an aluminum stud

being placed every 30 inches after the appropriate panels were in place on both faces of the assembly.

The last panels to be positioned were trimmed to a width of 14 inches to permit positioning of the panels without damaging them. This left a 1 inch gap between the edge of the panel and the side of the opening which was filled with vermiculite plaster on the exposed side of the assembly.

The test assembly herein described was subjected to a Fire Endurance Test according to the following method.

Fire Exposure - The furnace was fired in accordance with the time-temperature curve shown in the Standard for Fire Tests of Building Construction and Materials, ULC-S101, using a panel furnace and test equipment as prescribed by that method.

Temperature Measurements - The furnace temperatures were measured with 11 thermocouples symmetrically located in the furnace chamber.

The unexposed surface temperatures were measured with 11 thermocouples located at random on the face of the test assembly.

The temperature developed on the webs of the aluminum studs were measured with 8 thermocouples.

Deflections - The deflections of the partition were determined by measurement at the edges of the assembly and at the mid point of each full panel on the horizontal centreline of the unexposed surface. The reference line was a taut steel wire fastened to the steel perimeter of the test frame.

General - Throughout the period of the test observations were made of the character of the fire and the condition of the exposed and unexposed surfaces.

Developments pertinent to the performance of the assembly with particular reference to stability and the passage of flame were noted and recorded.

Results: Test positive - fire test terminated at 65 minutes. During the rating period of 60 minutes, the unexposed surface temperatures did not increase by an average of 250°F nor did an individual reading increase by 325°F over the initial temperature. The unexposed surface did not develop any openings that would permit the passage of flame or hot gases during the rating period. The fire resistance requirements of ULC-S101 were therefore met.

A similar assembly was subjected to an exposure of 30 minutes during which the furnace was again fired to the standard time-temperature curve shown in ULC-S101. After this 30 minute exposure, the assembly was subjected for a period of one minute to the cooling and erosion effects of a hose stream with a nozzle pressure of 30 psi. During this hose stream exposure, there was no passage of water through the assembly.

On the basis of the foregoing, the assembly described was judged by Underwriters' Laboratories of Canada to have achieved a one hour fire resistance rating.

While particular embodiments of this invention have been described and shown, it will be understood that many modifications may be made without departing from the spirit thereof, and it is contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A laminated wall panel comprising (a) type X fire resistant gypsum wallboard, laminated to (b) glass fiber impregnated gypsum wallboard.

2. A laminated wall panel as defined in claim 1 wherein the wallboard is of the type identified by the trade mark FIRESTOP-3.

3. The wall panel of claim 1 wherein the glass fiber content of wallboard component (b) is approximately three pounds per one thousand square feet.

4. The wall panel of claim 3 wherein wallboard component (a) is about one-half inch thick and wallboard component (b) is about seven-sixteenth inch thick.

5. The wall panel of claim 4 wherein wallboard component (a) and wallboard component (b) are bonded together with an adhesive which has a synthetic resin emulsion base of the polyvinyl acetate type.

6. The wall panel of claim 5 wherein the adhesive is selected from the group consisting of adhesive 4772 and adhesive TS-439.

7. The wall panel of claim 6 wherein a groove is located between the edges of wallboard component (a) and wallboard component (b) and the groove runs substantially the length of the panel.

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8. The wall panel of claim 7 wherein wallboard component (a) is greater in lateral width than wallboard component (b).

9. The wall panel of claim 8 wherein the edges of wallboard components (a) and (b) and the groove between the edges of the two wallboard components are covered with wallboard liner.

10. The wall panel of claim 9 wherein the edge of wallboard component (a) is angled about 3 degrees from the perpendicular in the direction of wallboard component (b).

11. A one hour fire rated wall system incorporating a plurality of the panels in claim 1, 9 or 10 in combination with a corresponding number of vertically disposed studs of I-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of said plurality of wall panels is secured in said abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of said I cross section shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels.

12. A one hour fire rated wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of said plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with

the flanges of said I-shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels, and wherein a second plurality of panels are arranged in a row in side by side abutting relationship said row being parallel with the first row of panels, and said second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of said I-shaped studs opposite to the flanges of said I-shaped studs engaging the edges of the plurality of panels forming the first row of panels.

13. A one hour fire rated wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of said plurality of wall panels is secured in said abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of the heads of said J cross section shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels.

14. A one hour fire rated wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of a first plurality of spaced vertically disposed studs of J-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of said plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the heads of said

J-shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels, and wherein a second plurality of panels are arranged in a row in side by side abutting relationship said row being parallel with said first row of panels, and said second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the head flanges of a second plurality of spaced vertically disposed studs of J-shaped cross section corresponding in number with the first plurality of J-shaped studs said second plurality of J-shaped studs being arranged in abutting relationship with said first plurality of J-shaped studs but being disposed in opposite direction, the flanges of said second plurality of J-shaped studs being of a thickness to be received snuggly in the grooves of the second plurality of abutting panels.

15. A wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of said plurality of wall panels is secured in said abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of said I cross section shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels, the wall system meeting the performance requirements contained in the Standard for Fire Tests of Building Construction and Materials, ULC-S101.

16. A wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of spaced vertically disposed studs of I-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of said plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wall- board components (a) and (b) with the flanges of said I-shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels, and a second plurality of panels corresponding in number with the first plurality of I- shaped studs are arranged in a row in side by side abutting relationship said row being parallel with said first row of panels, and said second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of said I-shaped studs opposite to the flanges of said I-shaped studs engaging the edges of the plurality of panels forming the first row of panels, the wall system meeting the performance requirements contained in the Standard for Fire Tests of Building Construction and Materials, ULC-S101.

17. A one hour fire rated wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of spaced vertically disposed studs of J-shaped cross section, wherein the plurality of panels are arranged in side by side edge abutting relationship and each adjacent pair of said plurality of wall panels is secured in said abutting relationship by mating engagement of grooves formed between the edges of wallboard components (a) and (b) with the flanges of the heads of said J cross section shaped studs, said flanges being of a thickness to be received

snuggly in said grooves of abutting panels, the wall system meeting the performance requirements contained in the Standard for Fire Tests of Building Construction and Materials, ULC-S101.

18. A wall system incorporating a plurality of the panels of claim 1, 9 or 10 in combination with a corresponding number of a first plurality of spaced vertically disposed studs of J-shaped cross section wherein a plurality of panels are arranged in a row in side by side abutting relationship and each adjacent pair of said plurality of wall panels is secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the flanges of the heads of said J-shaped studs, said flanges being of a thickness to be received snuggly in said grooves of abutting panels, and wherein a second plurality of panels corresponding in number with the first plurality of panels are arranged in a row in side by side abutting relationship said row being parallel with the first row of panels, and said second row of panels being secured in place by mating engagement of grooves formed between the edges of the respective wallboard components (a) and (b) with the head flanges of a second plurality of spaced vertically disposed studs of J-shaped cross section corresponding in number with the first plurality of J-shaped studs said second plurality of J-shaped studs being arranged in abutting relationship with said first plurality of J-shaped studs but being disposed in opposite direction, the flanges of said second plurality of J-shaped studs being of a thickness to be received snuggly in the grooves of the second plurality of abutting panels, the wall system meeting the performance requirements contained in the

Standard for Fire Tests of Building Construction and Materials, ULC-S101.

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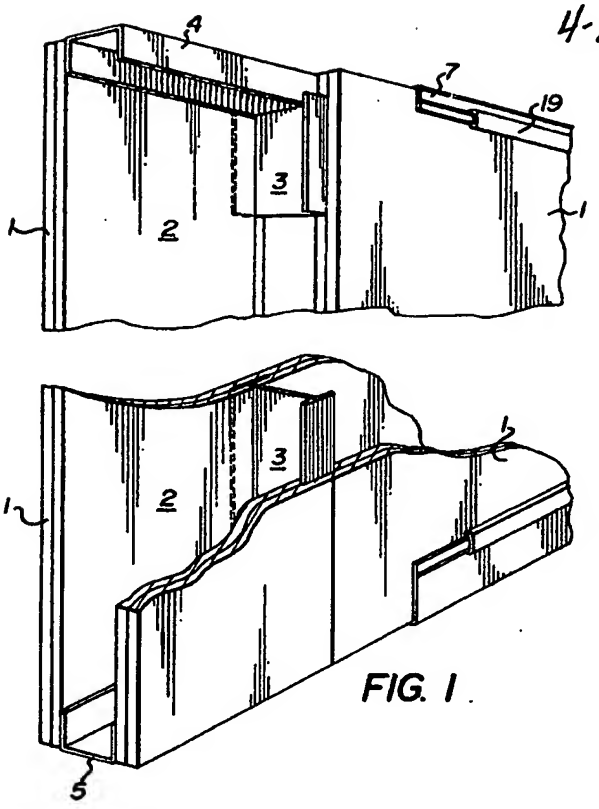

FIG. 1

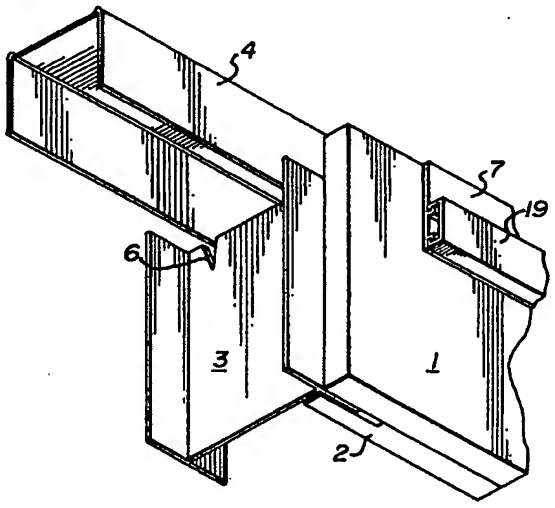

FIG. 2

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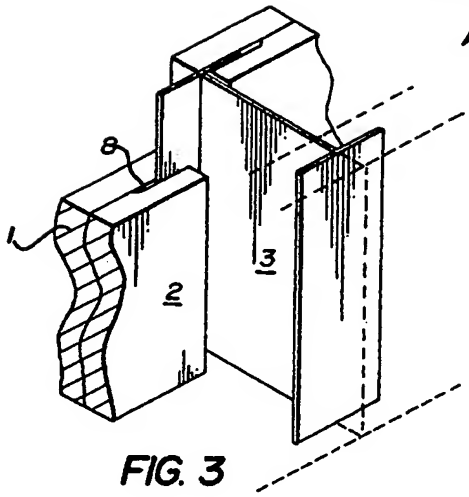

FIG. 3

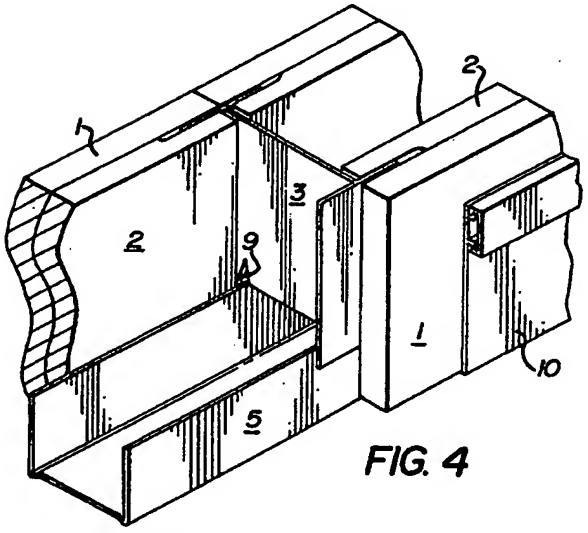

FIG. 4

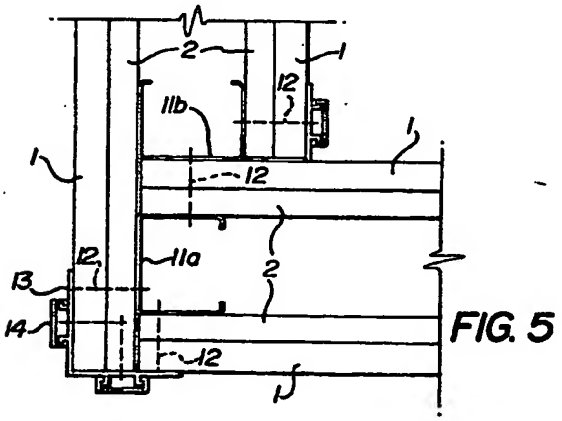

FIG. 5

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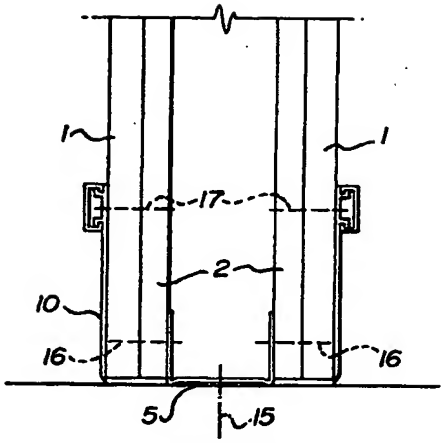

FIG. 6

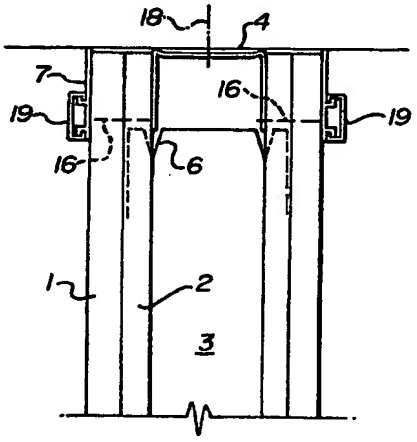

FIG. 7

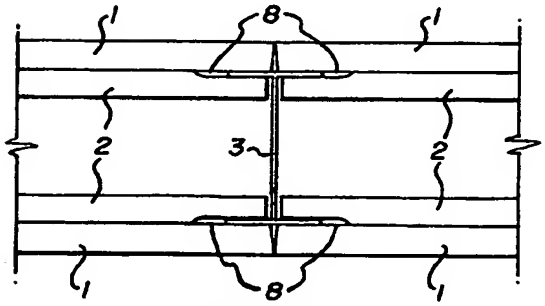

FIG. 8

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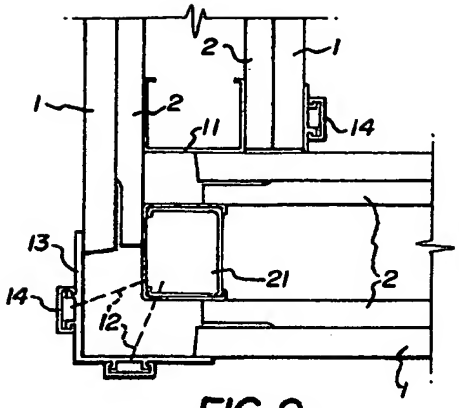


FIG. 9

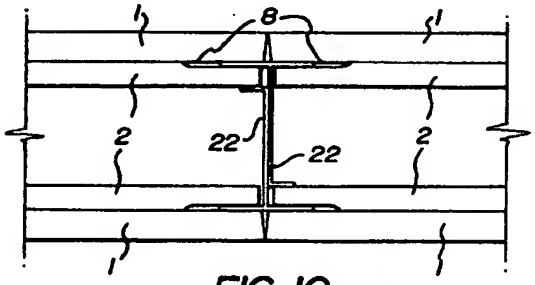
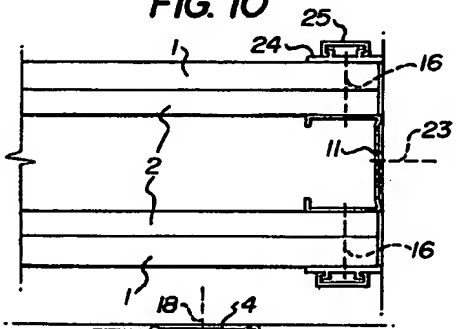


FIG. 10

FIG. 11



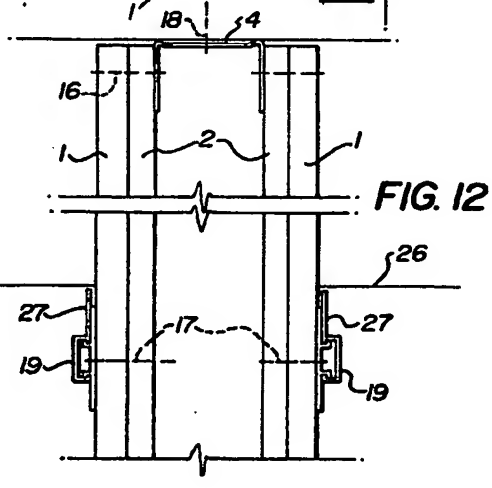


FIG. 12

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